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Ashton B. Carter

The Relationship of ASAT and BMD Systems

PUBLIC OPINION AND POLICY LEADERSHIP today insist on merging anti-satellite weapons and ballistic missile defenses under the general rubric of "Star Wars." But how accurate is it to treat ASAT and BMD as but two facets of a single security problem? At their earliest beginnings more than thirty years ago, ASAT and BMD were treated as naturally related security concerns, for the simple reason that missiles and satellites were both viewed as extensions of the long-range aircraft as a means of strategic attack. But in the intervening decades, ASAT and BMD programs have gone their separate ways. Satellites evolved to carry sensors and radio transponders, not nuclear warheads, while ICBMs have remained faithful descendants of the strategic bomber. ASAT and BMD therefore came to respond to distinct military missions and to pose distinct arms-control problems. There are sound reasons for public policy to treat them separately.

But while their military roles diverged, ASAT and BMD systems continued to share certain technical characteristics, and the argument for merging the two issues focuses precisely on this technological overlap. Because of this overlap, certain types of ASAT systems would possess marginal BMD capability, and many types of BMD systems would have quite substantial ASAT capability. Though this overlap must not obscure the substantial differences between ASAT and BMD, it does give rise to several genuine complications for BMD and ASAT policy. On the one hand, the overlap poses an "ASAT upgrade" problem: unrestrained development or deployment of ASATs having some BMD capability could circumvent the strict limits on missile defenses in the ABM treaty. On the other hand, imposing restraints on ASAT development could also impede development of advanced BMD technologies (or countermeasures to BMD) at an earlier stage than the terms of the ABM treaty alone would require; this might render comprehensive ASAT arms control incompatible with the Reagan administration's Strategic Defense Initiative (SDI). Proponents of the SDI could, on this ground, be led to oppose ASAT arms control, while critics of the SDI could use ASAT arms control as a political tool to suppress BMD.[1]

There are potential hazards in making ASAT and BMD policies hostage to each other in this way. If the policy debate over ASATs is wrongly transformed into a symbolic battle over BMD, we may lose the opportunity to judge the military utility of ASATs and proposals for ASAT arms control on their intrinsic merits. At the same time, some near-term BMD deployment options do not require space-based components, and the merits of these deployments may be overlooked if they are wrongly swept up in the drama over the "militarization of space." One should hope instead for a policy debate that addresses the overlap between ASAT and BMD, while respecting the basic differences between their roles in military security.

DIFFERENCES BETWEEN ASAT AND BMD

In the broadest strategic and military sense, ASAT and BMD have little connection. Ballistic missile defense is concerned with providing protection to the nation in the midst of nuclear war, and its affinities in overall military planning are therefore to air defense, civil defense, anti-submarine warfare, anti-tactical ballistic missile defenses, and other activities that have little or nothing to do with space or with ASATs.

Anti-satellite weapons, on the other hand, might well play a role in nuclear war, but many of the ASAT scenarios cited as worthy of concern have little or nothing to do with nuclear war; they range all the way from peacetime tampering with reconnaissance satellites through varying levels of use in crisis and conventional war. Indeed, ASAT use during nuclear war may not be regarded as the most worrisome use of ASAT, nor, for that matter, one that can be easily guarded against through satellite defense programs or arms-control agreements.

From the point of view of arms control, ASAT and BMD could scarcely be more different. The ABM treaty imposes firm and comprehensive restraints on BMD, and few question the ability of the United States to detect militarily significant violations of its provisions. Virtually no arms-control limits exist on ASAT activities, however, and many doubt the verifiability of agreements that would seek to eliminate all or most threats to satellites.

The argument that technological advances are blurring the distinction between ASAT and BMD and thus compel us to consider them as a single issue is in many ways overdrawn. It is true that both missions may involve intercepting objects at roughly comparable altitudes and speed. But the visibility and vulnerability of satellites, boosters, post-boost vehicles, and warheads differ somewhat; and satellites may orbit at altitudes many times higher than those reached by ICBMs. Future advances in directed-energy technologies might well bring greater commonality to ASAT and BMD weapons. But some very significant methods for disrupting satellite functions—space mines, attacks on ground stations, deception—have no BMD analogues. And important terminal and mid-course BMD systems now under study have no space-based components and would work at low-orbital or sub-orbital altitudes.

Above all, the performance requirements of effective ASAT and BMD systems are almost incomparable. ASAT attack can be mounted from a friendly country, but BMD interception of ICBM boosters must take place from outer space and over enemy territory. BMDs must handle many targets in a short time, whereas ASATs need engage relatively few targets at a leisurely pace. The ASAT operator picks the timing of attack; BMD must react to the initiative of the offense. BMD must operate in the most hostile circumstances imaginable—in the midst of nuclear war—whereas ASATs are just as likely to be used during crises or conventional conflicts.

In short, while there is little technical difference between the act of destroying a satellite in orbit and the act of intercepting an ICBM in flight, there is an enormous difference between the effective performance of a BMD *system* and an ASAT *system*.

EXAMPLES OF ASAT-BMD OVERLAP

To gain some sense of the balance between their technological similarities and performance differences, it will be useful to compare the capabilities of a few illustrative ASAT and BMD systems that share the same technologies.

Current Soviet ASATs and ABMs

The current Soviet ASAT interceptor is a multi-ton device launched by an ICBM-sized missile into an orbit that crosses the orbit of its target. It is guided in the final moments of intercept by a radar or optical homing sensor. The ASAT bears little or no resemblance to Soviet BMD systems under development, in either hardware or interception technique, and it has no BMD capability.

The Soviet Galosh ABM interceptor missiles deployed around Moscow, and currently being upgraded, can fly to altitudes of up to several hundred kilometers and laterally to comparable distances. Ground radars guide Galosh's ascent until it is close enough to its target, at which point its nuclear warhead detonates. Galosh's multi-megaton nuclear warhead could destroy satellites of today's design at ranges of many hundreds of kilometers. In upgrading the Moscow ABM system, the Soviets are deploying one hundred interceptors in all, some portion of them modified Galosh missiles. Galosh missiles therefore constitute, in principle at least, a potent nuclear ASAT system with several dozen low-altitude interceptors. It is even conceivable that with proper radar and guidance, Galosh could use a non-nuclear warhead for ASAT attacks. (The remainder of the upgraded Moscow ABM interceptors will be shorter-range missiles with little or no ASAT capacity.)

Current U.S. ASATs and ABMs

The U.S. homing vehicle ASAT, which would be launched by an F-15 and is undergoing testing, and the Army's Homing Overlay BMD device both involve guiding a small space vehicle to the vicinity of its target with a long-range sensor, activating an infrared homing sensor as the vehicle draws nearer to its target, and destroying the target by direct impact. The Army's Homing Overlay test of 1984, in which an ICBM warhead was intercepted and destroyed, demonstrated that objects at altitudes of several hundred kilometers and at near-orbital speeds can be intercepted by such homing devices. This homing technology is therefore clearly applicable to both ASAT and BMD, if matched to the proper boosters and integrated into an overall system.

If the United States were to deploy a BMD site consisting of a hundred Homing Overlay interceptors (the number permitted under the ABM treaty), together with appropriate radars or other long-range sensors, such a system would be capable (generically, at least) of making large numbers of low-altitude ASAT intercepts within a short time. Since the Overlay interceptor missile's range is envisioned to be long enough to allow BMD coverage of much of the continental U.S. from a central launch site, the Overlay system would not have to wait for satellite ground tracks to pass very near to the launch site to make ASAT intercepts. The system would therefore make intercepts within at most a few hours of receiving an attack order. On the other hand, this BMD system would threaten only low-orbit satellites.

The U.S. homing vehicle ASAT, as currently conceived, probably has no capability whatsoever to intercept missile warheads launched from the Soviet Union. Among other reasons, the long-range sensors that provide guidance for the ASAT mission (the spacetrack network of ground-based radars, which include the early-warning radars along U.S. borders) are probably inadequate for ICBM intercept, and communicating their data to the ASAT interceptor's guidance system in a timely manner is also probably impractical.

But let us suppose that the United States or the Soviet Union were to deploy an ASAT system consisting of homing vehicles such as those now being tested by the U.S., based not on F-15s but on ground-launched missiles capable of reaching high altitudes. Suppose appropriate long-range sensors for these ASAT interceptors were also provided. The small number of interceptors deployed for an ASAT-only mission—perhaps less than a hundred—would clearly not constitute a major BMD system. A system designed as an ASAT, and not adapted to the stringent requirements of BMD, would also be susceptible to the usual panoply of BMD penetration aids and countermeasures, including nuclear attack on its components. Seen from this point of view, such an ASAT system would seem to be an insignificant missile defense.

From another point of view, however, even this limited BMD potential could not be entirely neglected. A hundred long-range ASAT interceptors of this sort could defend the entire country against small attacks. Even against large attacks, preferential defense tactics would allow either superpower to ensure with high probability the survival of a small number of selected targets. It is precisely the possibility of employing limited ASAT systems in such ways that gives rise to the "ASAT upgrade" issue. This issue will be treated in further detail below, but from this example it is already clear that one's concern over ASAT upgrade is determined more by strategic outlook—whether the survival of a few selected targets makes a critical difference in strategic stability—than by technical details.

Space-based lasers

This discussion will confine itself to orbiting chemical lasers, but most remarks apply as well to orbiting particle-beam weapons. Here, the ASAT potential of a good BMD system is quite clear. If a space-based laser BMD system had the beam brightness and number of orbiting battle stations required for effective BMD, and if its sensors could be adapted to the task of finding satellites as well as missiles (probably a minor matter), it would be capable of instantaneous attack on satellites at all altitudes. Even against heavily shielded satellites, the laser beam could presumably dwell on the target long enough to cause damage.

A space-based laser system designed specifically for the ASAT mission, on the other hand, would probably consist of a smaller number of orbiting stations of lesser beam brightness and smaller fuel supply, since the total number of targets to be attacked would be fewer, and the time available longer, than for the BMD task. Moreover, an ASAT system would presumably not be designed to withstand very vigorous BMD penetration tactics. Both sides could easily calculate the potential of such an ASAT system to intercept ICBMs and SLBMs. The space-based laser ASATs would be able to intercept a small number (let us say fifty) of simultaneously launched ICBMs; it could intercept a larger number if the ICBM launches were spread out in time, permitting each laser to turn to new targets when finished with the first wave. In contrast with the previous case, a space-based laser ASAT of this sort would *not* have the capability for preferential defense of a few selected sites, since it would intercept ICBMs in the early stages of flight before they revealed their intended targets. However, a space-based laser ASAT could completely interdict small nuclear attacks (fifty missiles, in this case), thus forcing an attacker to mount far larger attacks or to employ special penetration aids for which the ASAT was unprepared. Once again there is a potential ASAT upgrade issue, depending on one's strategic outlook.

Ground-based lasers.

A ground-based laser BMD system would require much greater beam power than its ASAT counterpart, since its energy would have to be transmitted over longer ranges (up to an orbiting mirror and then back down toward the earth) and destroy its target as rapidly as possible. Such a BMD system would be able to attack satellites directly if they passed over its ground site, or destroy them over the horizon if its orbiting mirrors could be oriented for ASAT attacks.

A ground-based laser ASAT system would not require orbiting mirrors to redirect the beam, though such mirrors might in fact enable the system to attack a satellite without waiting for it to pass overhead. (An orbiting mirror would also permit use of adaptive optics to compensate for degradation of the laser beam as it passed through the atmosphere.[2]) Without mirrors to bend its beam around the earth, such an ASAT would clearly have no BMD capability, and even with mirrors its beam would not be powerful enough for BMD if originally designed only for the ASAT mission. A ground-based laser ASAT could be a way station en route to a BMD capability, however, allowing tests of basic techniques that could later be scaled up to BMD requirements. The U.S. SDI program will reportedly follow this route in its investigation of excimer lasers.[3]

X-ray lasers

X-ray lasers, powered by nuclear explosions, could be stationed in space, but they are also light and compact enough to be employed in a "pop-up" mode in which the weapons would be rapidly launched into space when needed. An orbiting X-ray laser would display much of the same ASAT-BMD interaction as the space-based chemical lasers described above.

A pop-up X-ray laser BMD system deployed by the U.S. near Soviet borders in order to intercept ICBMs (probably a quite impractical approach), or along U.S. coasts to intercept Soviet SLBMs, could clearly double as an ASAT system. The missile carrying the laser device would merely need to climb above the atmosphere (or to an altitude where the X-ray beam could "bleach" its way through the upper atmosphere) and detonate, destroying any satellite within its—potentially long—range and line of sight.

An X-ray laser would have an advantage over an ordinary ground-launched direct-ascent ASAT interceptor since it would not need to ascend all the way to its target to destroy it. Because X-ray lasers would be powered by nuclear explosives detonated in space, however, they would be appropriate for ASAT use only in extreme circumstances when breaching the nuclear threshold was thought acceptable. Such a pop-up laser ASAT deployed on U.S. soil would have no capability to intercept ICBMs ascending from the Soviet Union, since it could not attain line-of-sight altitude to the ICBMs before they burned out. On the other hand, such a system might have limited use in intercepting SLBMs launched from near U.S. coasts, thus raising again, in a very constrained form, the ASAT upgrade issue.

Sensors

Like the weapons themselves, the sensor systems that support BMD and ASAT systems can serve a dual purpose. In the past, the tracking of ICBM warheads for BMD has been performed by ground-based radars, at least some of which would also be capable of tracking satellites at lower altitudes. This tracking data would allow the ASAT to plan its attack and to respond to the launch of a new satellite within several orbital revolutions. Conversely, radars built for space-tracking can also track ICBMs. However, to avoid ambiguity, a nation can locate its space-track radars in places inappropriate for BMD (for instance, beyond national borders or along the nation's periphery and facing outward).

The U.S. has considered replacing or augmenting its space-track radar network with a Space Surveillance and Tracking System (SSTS) consisting of satellites with infrared sensors able to distinguish space objects as warm spots against the cold background of space. Such sensors would be able to track not only satellites but also ICBM warheads and post-boost vehicles, and they are in fact under investigation in the SDI. For the BMD task, such sensors would have to be able to detect and keep track of thousands or tens of thousands of targets instantaneously and to discriminate missile warheads from decoys. For the ASAT task, it would be sufficient to be able to track fewer targets and to discriminate over a longer period of time. But it may be difficult for either side to judge, when looking at the other side's sensor systems, precisely what their capacities are.

If such sensors are able to track ICBMs "in flight trajectory" with enough precision to support a BMD mission, they might qualify as "ABM components" under the terms of the ABM treaty. If so, deployment of SSTS's for ASAT support would violate the treaty's ban on space-basing of ABM components. A similar problem to ASAT-BMD overlap has already arisen with the case of the Soviet radar under construction at Krasnoyarsk in the central Soviet Union. The Soviets claim the Krasnoyarsk radar is for space-track only; the U.S. points out that the radar's inherent BMD capability (however limited) was precisely the reason the ABM treaty required that such radars be deployed only on the Soviet periphery. Further issues of ASAT-BMD overlap could emerge with the use of other types of sensors, such as space-based radars, laser radars, and satellites with short-wave infrared detection sensors.

A number of general principles emerge from this brief review of ASAT and BMD technologies. An efficient BMD system could, with little or no effort, be made a potent ASAT, though in some cases with only limited altitude capability. A system designed specifically for the ASAT mission, on the other hand, generally would be a poor BMD. However, in many instances the technology itself would not distinguish between the two missions in a way that would make possible a clear judgment that an ASAT system had *no* BMD capability. Actual ASAT and BMD systems might in fact have particular limitations resulting from details of their design that would prevent or constrain dual use. But such detailed limitations might not be visible to another nation's intelligence analysts. Finally, even the rather limited BMD capacity of dedicated ASAT systems might be viewed as strategically significant by one side or the other. It is from these complications that the ASAT upgrade issue arises.

THE ASAT UPGRADE ISSUE

Early BMDs evolved out of surface-to-air missile (SAM) systems used for intercepting bombers. From the start, there was concern that SAM systems might be upgraded to enable them to intercept missile warheads as well as aircraft. Since missile warheads travel twenty or thirty times faster than aircraft and have much smaller radar visibility, missile defense requires better radars, faster data processing, and faster interceptor missiles than air defense.[4] The SAM systems use the same type of components—radars and interceptors—as BMD systems, and it is possible that these interceptors might, in the right circumstances (such as being equipped with nuclear warheads), be capable of intercepting missile warheads. Particularly susceptible to interception are those warheads with low reentry speeds, such as older models and some submarine-launched models. By deploying SAM systems with BMD potential, a superpower could circumvent the limits of the ABM treaty. The treaty's litmus test for SAM upgrade is whether the SAM system has ever been tested against strategic missile warheads. Such testing "in an ABM mode" would qualify the SAM as a BMD for treaty purposes.

American concern with SAM upgrade began with the Soviet SA–5 in the 1960s and continues today with the SA–10 and SA–12. Over the years, the Soviets have improved the capabilities of their SAMs to keep up with improved U.S. bomber capabilities. At the same time, U.S. missile warheads have grown faster and harder to detect. Despite their ability to intercept certain U.S. missile warheads under some conditions, Soviet SAMs are clearly not designed as BMDs, and *as systems* their BMD potential is extremely limited. In general, their radars cannot search for missiles at long range over wide sectors of the sky, do not seem to have the data processing capability to handle large numbers of warheads quickly, cannot discriminate warheads from decoys, and their interceptors cannot handle modern fast warheads and certain reentry angles. All in all, the effectiveness of Soviet SAMs against U.S. missile attacks would be marginal.

Nonetheless, there have sometimes been reasons why SAM upgrading has seemed more plausible than it needed to be. In some early U.S. ICBMs, for example, the warhead and upper booster stage flew close to one another, allowing a relatively unsophisticated Soviet radar to use the large upper stage as a locator.[5] Also, it is of little comfort to point up a Soviet SAM's susceptibility to penetration aids such as decoys if the United States has not incorporated such aids in its offensive planning. What is more, there are circumstances (at least according to some analysts) in which the ability to intercept a few U.S.

warheads would be significant if it could give the Soviets a virtual guarantee that a few selected targets in their country would survive.

The analogous ASAT upgrade issue stems from U.S. fears that the Soviet Union might deploy a system nominally intended for ASAT use, but in fact capable of BMD. Even if they did not deploy such a system, the Soviets might develop advanced BMD technology in the guise of ASAT development, preparing for "leakout" or "breakout" from the ABM treaty. By testing against orbiting objects but not against missiles "in flight trajectory," the Soviets could seek to evade the treaty's strictures on BMD development. ASAT activities that pressed upon the edges of the ABM treaty would cause both sides to hedge their bets against surprises by pushing forward their own programs. A spiral of mutual fear and suspicion might ultimately erode whatever arms-control relationship the two sides wished to preserve.

A future ASAT upgrade issue would probably recapitulate the SAM upgrade problem. As in the SAM case, no one would claim that if one set out to design ASAT-only and BMD-only systems from scratch that the two *system* designs would have much in common, although individual components might use similar technologies. At issue instead would be the strategic significance of an ASAT's limited BMD capability, and this in turn would depend more on the observer's broad strategic outlook than on technical details. To those convinced that the ability to deliver large numbers of nuclear warheads to the Soviet Union is sufficient to assure deterrence, a Soviet ASAT's modest BMD capability would be meaningless, even in a case where U.S. retaliatory forces had already been reduced by a Soviet first strike. To those convinced that the ability to assure destruction of selected military targets is essential to deterrence, however, even minor Soviet interference with U.S. missile attack plans would be unwelcome. Opinion would differ even more over the extent to which Soviet ASAT work would prepare them to develop truly effective BMD and place them in a position to circumvent or abrogate the ABM treaty. Anxious observers would point to common components—weapons and sensors—while doubters would point to the very different system requirements of ASAT and BMD.

To illustrate these ambiguities, we will consider two hypothetical examples of ASAT upgrading, one of U.S. and one of Soviet deployment. These examples are purely illustrative, and are not judgments or predictions about the actual future of ASAT upgrading.

Example 1. The United States deploys an ASAT system consisting of fifty land-based missiles carrying infrared homing vehicles. The ASAT system uses data from ground-based radars and from a Space Surveillance and Tracking System (SSTS) to select targets and to guide the homing vehicles to their vicinity. The United States tests its system extensively against a variety of orbiting targets, but never against sub-orbital objects.

The Soviets worry that these fifty interceptors could be used against missile warheads. Fifty warheads is a small fraction of a Soviet arsenal of thousands. But with its interceptors, the United States can try to preserve a handful of targets selected secretly from the large number targeted by the Soviet Union—a few airfields capable of servicing U.S. airborne command posts and bombers, a ground-command post, an antenna for communication with strategic submarines, a satellite ground station, a radar, a few Minuteman missiles outfitted with radios for broadcast of launch orders. This preferential defense is a substantial annoyance to Soviet planners, since they must now target several warheads at every target they wish to be confident of destroying, and the United States can virtually assure the survival of a small number of carefully chosen targets (by using all fifty interceptors to defend ten sites, for instance).[6] In small or selective Soviet attacks, the relative effect of a small U.S. BMD capability would be greater still.[7]

Adding another twist to this example, suppose the United States now tests from the Kwajalein Atoll (the terminus of the western ICBM missile test range) a BMD interceptor using a different booster from that used by the ASAT system, but with a very similar homing vehicle. Fixed, ground-based radars provide long-range data to guide the BMD interceptor to its target, but the SSTS gathers data in an adjunct mode during the tests. The Soviets protest that the fifty-missile ASAT system has, in effect, now been tested "in an ABM mode" as well. They assert that since the SSTS might be used to replace, rather than supplement, the ground-based radars, this test violates the ABM treaty's ban on space-based sensors. The United States rejects this interpretation, and deploys 150 more ASAT interceptors. The United States also maintains the industrial capability to produce more homing vehicles, prompting Soviet fear of a U.S. BMD breakout. The Soviets, hedging their bets against this possibility, consider deploying more ICBMs, penetration aids, and their own BMD.

Example 2. The Soviets launch a space structure combining a moderately powerful chemical laser with a large mirror. They test destruction of satellite targets, using a long-wave infrared SSTS and possibly laser radars to direct the laser beam. Eventually a total of ten such lasers appear in orbit.

The United States realizes that these laser satellites could attack ICBM and SLBM boosters and post-boost vehicles, even though the lasers are a hundred times less capable than would be required to handle simultaneous launch of hundreds of U.S. ICBMs. The Soviet lasers can therefore destroy, let us say, between ten and one hundred U.S. ICBMs boosters in a U.S. missile attack. The United States does not wish to go to the cost and trouble of countering the Soviet lasers with specialized penetration tactics. The Soviet lasers threaten a larger fraction of U.S. SLBMs, since SLBMs are spread over wide ocean areas where they are subject to attack by many orbiting lasers. Against a U.S. ICBM force reduced by a Soviet first strike, the Soviet protection is greater still. However, the Soviet lasers cannot accomplish the preferential defense that the U.S. ASAT in the previous example was able to accomplish, since the precise destination of U.S. missiles is not apparent during their boost phase. The Soviet lasers can also attack British, French, and Chinese missiles, creating great concern in these nations.

Over the years, the Soviets replace their early versions of these laser satellites with new models. U.S. intelligence cannot estimate precisely the output of the factories that make the lasers, the unit costs, or the characteristics of future models. U.S. intelligence also cannot determine whether inactive Soviet laser satellites that remain in orbit are capable of reactivation. The Soviet lasers have never been tested against strategic ballistic missiles "in flight trajectory," but they have been tested against a variety of orbiting targets. The Soviet Union has also performed, in other space programs, pointing and tracking experiments on ballistic missiles.

The United States considers survival of the Soviet lasers in wartime intolerable and makes contingency plans to attack them with ground-based lasers.

These examples, though somewhat fanciful, demonstrate the potential for a real ASAT upgrade dilemma. Doubters can always claim that a nation intending to use its ASAT for BMD would only be able to intercept a fraction of opposing missiles. Yet others worry that even a modest capability could be useful against SLBMs, against third powers, and against ICBMs in some scenarios; that the defense's capability poses an especially alarming threat to a retaliatory force that is reduced and disorganized by a first-strike attack; that the offense will not, in fact, deploy penetration aids that could overcome the defense; or that breakout or further upgrading is imminent.

ASAT ARMS CONTROL AS AN IMPEDIMENT TO BMD RESEARCH

A second aspect of ASAT-BMD overlap involves possible arms-control agreements. The ABM treaty permits research and restricted development of BMDs. Both nations value this latitude to seek more effective BMD concepts and to hedge against unexpected activities by the other side. In the United States, the Reagan administration has made such research a major part of its Strategic Defense Initiative. ASAT arms control might increase the limits on BMD-related activities and impede progress of the SDI.

One can think of a few explicit cases of conflict between possible ASAT bans and useful BMD development activities. For instance, the ABM treaty permits the United States to test-launch interceptors from Kwajalein against missile warheads. Such a test system might well be considered a low-altitude ASAT, even if it were never tested against orbiting objects. An ASAT treaty intending to ban low-altitude ASAT capabilities would either have to ban such tests or draw a dubious distinction between intercept of orbital and sub-orbital objects. To take another example, suppose the United States wished to develop powerful ground-based lasers and associated adaptive optics to investigate their BMD potential; an ASAT treaty might prohibit propagation of high-energy laser beams from the ground to orbiting targets. The extent to which ASAT bans would actually impede BMD research that is genuinely necessary to explore the technology's potential would obviously depend on both the details of an ASAT treaty and the degree to which BMD researchers are able to maneuver around treaty limitations.

Perhaps the main impediment that ASAT arms control presents to the SDI is political rather than technical. Public debate will very likely construe even carefully delimited ASAT negotiations as applying to all space weaponry, and will interpret U.S. participation as an implicit commitment to tone down the national initiative on BMD. Proponents of ASAT arms control will advertise their wares as a tool to combat the SDI, even though the ABM treaty already places thoroughgoing limits on deployment and on many types of development of advanced BMDs. Opponents of the SDI might be led to support ASAT arms-control negotiations they otherwise would not attach much importance to.

ASATS AS COUNTERMEASURES AGAINST BMD

If ASAT technology has much in common with that of advanced BMDs, it is even more directly linked to advanced offense, that is, to countermeasures against defensive systems. All advanced BMDs envisioned rely on weapons or crucial sensors based in space. ASAT attack on these components is probably the cheapest and most effective offensive countermeasure.

Since the signing of the ABM treaty, the United States and the Soviet Union have conducted penetration-aid research as a hedge against breakout, as a challenge to their own BMD R&D programs, and as a continuing demonstration of the treaty's underlying principle—that confident and cost-effective defense of their national territories is not possible. This research, it is widely agreed, strengthens both sides' confidence in the treaty.

If aggressive BMD research programs proceed, both sides will presumably wish to develop and test ASAT interceptor missiles, space mines, and directed energy weapons that could be used against BMD battle stations. Limitations on testing and deployment of ASAT, by depriving the two sides in some measure of the opportunity to demonstrate their ability and determination to counter defenses, might have the paradoxical result of increasing the two nations' fear of breakout, and might even tempt them to initiate deployment of BMDs that could not survive ASAT attack.

FOUR FUTURES

The importance of shared ASAT-BMD characteristics and functions depends largely on the future course of legal restrictions. There are four conceivable ways in which arms-control limits on BMD and ASAT systems could be combined: 1) the status quo, with an ABM treaty and no ASAT treaty; 2) an ABM treaty plus an ASAT treaty; 3) an ASAT treaty but no ABM treaty; and 4) no limits on either ASAT or BMD systems. Quite apart from the intrinsic merits and demerits of ASAT and BMD arms-control limitations, it would appear that in all four combinations the overlap of ASAT and BMD will give rise to problems and inconsistencies.

1) ABM treaty; no ASAT treaty.

The most important issue in this case would be whether unrestrained ASAT activity would ultimately erode the ABM treaty. ASATs tested solely against orbiting objects would not fall under the treaty's defining criterion, since they would not be tested against ballistic missiles in sub-orbital flight. Both sides could thus test space-based, mobile, and other ASAT components that are technically akin to BMD components, circumventing the treaty's ban on all but fixed, land-based, radar-plus-interceptor BMD systems. Actual deployment of ASATs that possessed the potential for upgrading to partial BMDs would create further anxieties. If the SAM upgrade precedent is any guide, debate in the United States over the threat of Soviet ASAT upgrading will turn less on estimates of the technical capability of the Soviet ASAT to intercept missiles than on the strategic significance of the modest BMD potential of the ASAT.

Though the technical requirements of effective ASAT are much less challenging than those of effective BMD, there seems to be no legal formulation that distinguishes between the two missions so as to dispel all ambiguities.[8] In an amicable period of U.S.-Soviet relations, regular discussions might temper the disruptive effects of these inevitable ambiguities. But it would not be easy in the best of climates to strike a constructive balance, in the United States at least, between a willingness to tolerate some ambiguities and a determination to challenge Soviet behavior that surpasses comfortable bounds.

2) ASAT treaty and ABM treaty

Supposing the United States and the Soviet Union wished to limit ASATs, managed to satisfy verification requirements, and found enough common ground to proceed to agreement; they would still have to accept the fact that ASAT limitations will constrain their BMD research programs. If the ASAT treaty forbids test interception of orbital objects, for instance, can it tolerate the tests against suborbital objects explicitly permitted by the ABM treaty? Even if the ASAT negotiations handle the technical ambiguities in such a way so as to minimize interference with BMD research, political opinion in the United States is very likely to view the spirit of the ASAT treaty as obliging the United States to scale back its Strategic Defense Initiative.

3) ASAT treaty but no ABM treaty

For obvious political reasons, collapse of the ABM treaty seems unlikely to coincide with wide-ranging ASAT arms control. But even if compatible politically, unrestrained BMD is incompatible technically with a comprehensive ASAT ban since almost all types of truly effective BMDs would also be overwhelmingly powerful ASATs. On the other hand, some observers imagine a time when both sides cooperate in limiting ASAT activity during or after deployment of advanced space-based BMDs, peacefully ushering in a defense-dominated world. One may doubt the plausibility of this political vision, but it is logically possible.

4) No arms control

If enthusiasm for technical advances or snowballing political misunderstandings lead the two superpowers to abandon the ABM treaty, there will no longer be any question of the legal compatibility of their ASAT and BMD programs. The technical outcome of this future is uncertain, but it is possible that potent ASATs would drive BMD deployment from space, and that other military support missions heretofore conducted from space (communications, reconnaissance and surveillance, navigation, meteorology) would have to find more survivable backups. In such a world, space would be ASAT dominated, and strategic warfare would remain offense dominated.

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Although there is as much perception as reality in the overlap between ASAT and BMD, the reality is nonetheless palpable and unavoidable. It grows out of certain inherent technical similarities between the two types of systems, to which is added a strong (if not always well-informed) popular identification of ASAT and BMD as one and the same "Star Wars" vision.

But in fact ASAT and BMD systems respond to fundamentally different security concerns. ASATs challenge the rather paradoxical proposition that space—alone among earth, sea, and air—should be a sanctuary in which satellites can conduct a wide range of military activities, such as surveillance and navigation, free from fear of destruction. BMD concerns itself with only one military contingency—the ultimate contingency of nuclear war—and with the proposition that the imperfect defenses which it is within technology's power to build can contribute to avoiding such an event.

Until public policy settles on an answer to these two propositions separately, a policy for managing their overlap will continue to elude us. Indeed, discussion of the subject both in the U.S. and in the 1985 Geneva arms-control talks seems to be taking an opposite path, considering ASAT and BMD precisely in their region of overlap. To do this risks forfeiting judgment of each on its own merits, while at the same time making resolution of one dependent on resolution of the other. Only when we have clear policies on ASAT and on BMD individually will their difficult area of overlap prove tractable.

ENDNOTES

[1] These issues have been raised previously in a similar vein by Donald M. Kerr, "Implications of Anti-Satellite Weapons for ABM Issues," paper prepared for the SIPRI Symposium on "Outer Space: Can Militarization be Checked," Stockholm, Sept. 21–23, 1983 (Los Alamos report LA–UR–83–2455 [Rev]):

> Without an ASAT Treaty, development and deployment of directed energy ASAT technology would offer a severe challenge to the present ABM Treaty regime, as well as posing potentially serious new realms for military

competition and threatening one of the key stabilizing and limiting mechanisms between the superpowers. On the other hand, the negotiation of a restrictive ASAT treaty, because of the substantial intermingling of ASAT and ABM technologies, might pose insurmountable obstacles to the development of many of the most promising BMD technologies.

[2] See Ashton B. Carter, *Directed Energy Missile Defense in Space* (U.S. Congress, Office of Technology Assessment, April 1984), Chap. 3.

[3] Clarence A. Robinson, Jr., "BMD Research Draws Strategic Focus," *Aviation Week & Space Technology*, June 18, 1984, p. 83.

[4] See Stephen Weiner, "Systems and Technology" in *Ballistic Missile Defense*, ed. Ashton B. Carter and David N. Schwartz (Washington D.C.: The Brookings Institution, 1984) pp. 73–74.

[5] See Sayre Stevens, "The Soviet BMD Program in Carter and Schwartz, op. cit., p. 206.

[6] See Ashton B. Carter, "BMD Applications: Performance and Limitations," in Carter and Schwartz, op. cit., p. 104 and 150ff.

[7] See "Defense Against Ballistic Missiles: An Assessment of Technologies and Policy Implications," (Department of Defense, April 1984), containing conclusions of the Future Security Strategies Study headed by Fred S. Hoffman.

[8] A strictly legal distinction could be based on ASAT intercept of *orbiting* objects and BMD intercept of objects on *suborbital* trajectories that intersect the earth's atmosphere. Whether a space object intercepted by one side in a test was on an orbital or suborbital trajectory would be easy for the other side to determine. The ABM treaty defines a BMD as "a system to counter strategic ballistic missiles or their elements in flight trajectory." A corresponding ASAT treaty could refer to "space objects in stable orbits." The legal distinctions would then be clear: a system never tested against suborbital objects (i.e., "never tested in an ABM mode") would not be subject to ABM treaty limitations, and a system tested only against suborbital trajectories would be immune from ASAT treaty restrictions (since it was never tested "in an ASAT mode"). While this distinction is legally neat, technically unambiguous, and easy to verify, few would accept that an extensively tested BMD had no ASAT capability and vice-versa. As always, it is the *capability* of a system, and not its nominal or declared purpose, that must form the basis of treaty definitions.